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The Urbanization Process of Luzhu District in Kaohsiung-A Case Study of Kaohsiung Science Park

WORKSHOP 5

Innovative business models for STPs in response to city challenges

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Kaohsiung Science Park - C

The Regional Development of Luzhu District in Kaohsiung-A Case Study of Kaohsiung Science Park

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Summary

This study is based on the history of Kaohsiung Science Park, trying to explore the regional development of Luzhu District in Kaohsiung in the past four years. The aim of this paper is to provide empirical evidence to study the role of Kaohsiung Science Park (KSP), the branch of Southern Taiwan Science Park (STSP), in the regional development process by studying the actors participating in the project "Biomedical Devices Industrial Cluster Establishment Project". According to this study, the main influence factors possibly include the population, transportation, the number of employee, supermarket, and the tenanted companies, etc. With the collection of information about the aforesaid influence factors for four years, we are trying to analyze how the KSP changes the industry in the city; in addition, how the Southern Taiwan Science Park Administration (STSPA) cooperated with local research institute, Metal Industries Research & Development Centre (MIRDC), to help the park industries.

Keywords: Southern Taiwan Science Park (STSP), Medical Device, Regional Development

1. Introduction

The industrial development is often associated with the regional development. Tainan Science-Based Industrial Park was established in Tainan City in 1997 and it was expanded and renamed as Southern Taiwan Science Park (STSP) in 2003. From then on, the STSP includes the Tainan Science Park (TSP) and the Kaohsiung Science Park (KSP). In other words, the KSP was established in 2003 as the second site managed by Southern Taiwan Science Park Administration (STSPA). As we know, TSP is famous for its Integrated Circuits industrial cluster. Therefore, STSPA tried to apply the successful experience of formatting the TFT-cluster into the upgrading projects for Medical Device. To improve the competitive advantages of KSP, medical device (MD) industry is chosen as a target industry to develop in KSP because it combines the medical industry with metal industry. According to Kung and Yen[1] (2012), MD industry is chosen under the trend for upgrading with the three main reasons. Firstly, MD industry has the opportunities to combine different field's high-tech technologies with metal, precise machine, chemical, and plastic industry in which it has high reputation in manufacturing sector. Secondly, the MD industry is comparatively a new industrial sector all over the world, even the major associations in the USA, for example, MDMA and MassMEDIC, have been established only since the 1990s. Thirdly, it is widely recognized as very potential in the future, basically because of the global increase of ageing population as well as the rising awareness of the value of health.

The KSP is situated between Luzhu, Gangshan and Yongan District of Kaohsiung, the traditional manufacturing-based industry in these areas, as mentioned in above paragraph. KSP has strong intention and is willing to develop medical device industry. Actually, Kaohsiung, which is located in southern Taiwan, is commonly known as a city of traditional industry. With its excellent geographical environment, Kaohsiung once ranked the world's third largest commercial port. In the past, Kaohsiung was famous for its metalwork industry in Gangshan and Luzhu District; however, with the trend of economic globalization and migration of Taiwan's industry, Kaohsiung Port declined in the world rankings. Therefore, transformation is a must for Kaohsiung's industries in order to resolve the aforesaid issues.

In response to the changing market and development trend towards industrial transformation and upgrade, many local industries try to find another way to create business opportunities with high value-added industry. With aging population being a global trend, high value-added medical device industry becomes the focus for these industries. The capability of precision molding, plastic injection and metal processing is the strong foundation for local industries to change into medical device industries. It is one of the reasons why the Southern Taiwan Science Park (STSP) could attract 37 enterprises for an investment amount of US$ 176 million and create about 600 jobs after the promotion campaign of the "Biomedical Devices Industrial Cluster Establishment Project" for almost 4 years. The strategy is to utilize the R&D strength of the academic and research institutions to transform the traditional metal processing industry into a medical device industry. The industrial cluster is further completed with the presence of dentistry and orthopedics device manufacturers. Now, in Taiwan, Kaohsiung has become the city with the highest proportion of medical device company establishments.

From the above-mentioned circumstance we could find that the rise of medical device industries improves the development of surrounding areas. The reason why the medical device industries could develop in Luzhu is the technology of metal, steel and chemical industries in Luzhu and the surrounding area provides a good environment for medical device industries. The city promotes the development of the industries and vice versa; this condition is like an ecosystem. According to the experience in Taiwan, when the development policy of a science park is made, not only the suitable industry category but also the location and the capability in surrounding area should be considered.

In view of above, this study tried to explore the development history between medical device industries and Southern Taiwan Science Park, and it is expected that this development experience will be a reference in the future.

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[1] S-F KUNG, Y-C YEN, B-C WU, C-W CHEN, C-M CHEN, B-W HUANG, *The Study of the Relationship between Southern Taiwan Science Park and Regional Innovation Network*, 2012.

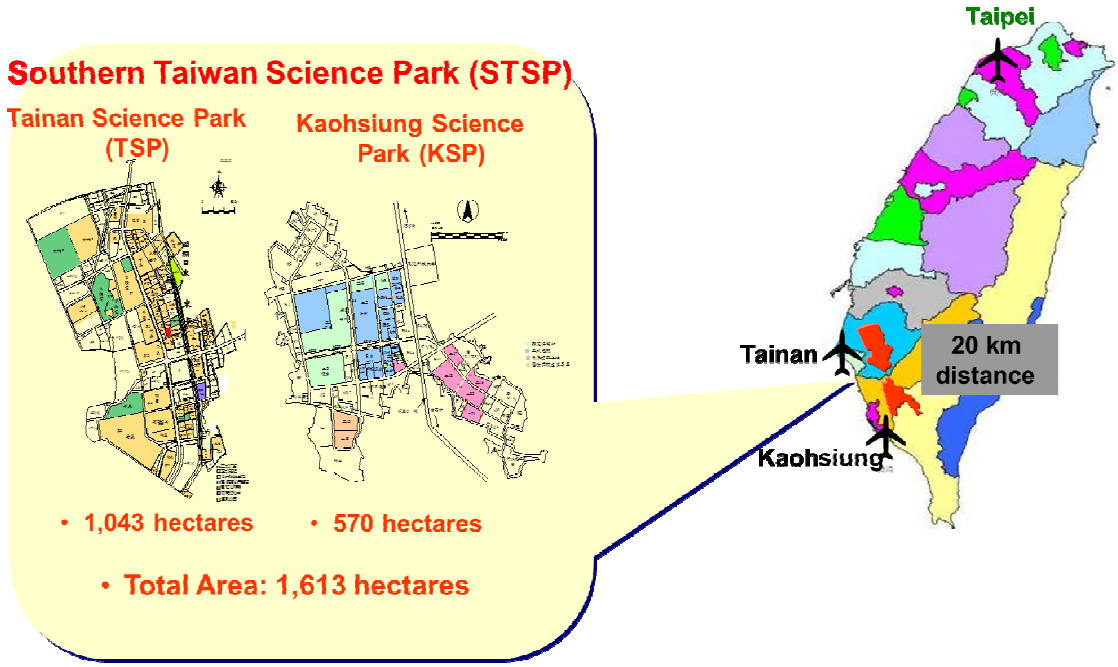

Figure 1: The Location of the TSP and KSP in Taiwan

2. An Overview of "Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project"

From 2009 to 2013, the project "Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project" is promoted by Southern Taiwan Science Park Administration (STSPA) and executed by Metal Industries Research & Development Centre (MIRDC). Nearly NT$1.2 billion, which is equivalent to US$ 4 million, have been invested in promoting the "Southern Taiwan Biomedical Device Industry Cluster Establishment Project" to upgrade the technology and value of small and medium traditional manufacturers in southern Taiwan. One of the goals of this project includes upgrading and transforming the industry in Taiwan. This project is a method for the industry to tenant in Southern Taiwan Science Park (STSP) more easily due to the industry could get financial support from the Southern Taiwan Science Park Administration (STSPA) and the technical and professional services from Metal Industries Research & Development Centre (MIRDC). The Southern Taiwan Science Park Administration (STSPA) provides the subsidy for the industry to do research and development on the medical device products. It could help the industry to upgrade the products or transform the traditional industry into medical device industry quickly by obtaining the financial support from the Southern Taiwan Science Park Administration (STSPA). STSPA is not only the sponsor but also the consultant. STSPA and MIRDC also help the park enterprises to do international marketing, for example, participation in famous exhibitions with national pavilion; provides the medical device regulation consulting service, etc.

Clusters have become a popular key word and new planning concept of discussion and analysis in contemporary debates on regional development including "Third Italy" and "Silicon Valley". Regarding the theory of industrial cluster, many significant literatures highlight the importance of the firm clustering in space. From Marshall's external economy, agglomeration economics studied by Weber and Hoover, Porter's analysis of national competitive advantage, to Saxenian (1994) compared the case between Silicon Valley with Route 128. Porter[2] (1990) in his book "National competitive advantage"

[2] Porter, Michael E., *The Competitive Advantage of Nations*, New York: Free Press, 1990.

indicated that the competitive advantage in nation is dependent on their competitiveness, meanwhile, the cluster which has the external economy, innovation and cooperation effect, just could be the driving force to promote national and regional economy development. Therefore, how to promote the formation, development and upgrade of cluster, and make a cluster-based policy, is already becoming a hot issue in the planning field.

STSP now has 328 tenanted companies with a total of about 65,000 employees and the total revenue of park enterprises is around US$ 12 billion in 2012. No doubt, it is now an important high technology industrial area in Taiwan and one of the world-class TFT-LCD and Integrated Circuits industrial clusters.

With almost 4 years of project execution, 37 firms have tenanted in the STSP which includd 17 dental device companies, 4 orthopedic companies, 4 medical cosmetic companies and 12 other medical device companies, forming a medical industrial cluster in southern Taiwan.

3. Cluster and Spatial Development

As a late-comer in industrial development, Taiwan started its way on high technology industrial cluster building, as a strategic trajectory leap forward in industrialization, and selected from advanced industrial societies the development strategies perceived as suitable to the island. United States and Japan in particular, have been the focus of such studies. "High technology industrial cluster" is a combination of two terms welcomed by many high technology and industrial cluster. Moreover, it has to be carried out in space. Since 1980s, the "high tech fever" or "high-tech fantasies" have swept most of the world (Rogers & Larsen, 1984; Makusen et al, 1986; Massey et al, 1992); and following Porter (1990), industrial clusters have become one of the hottest research and policy fields since 1990s (OECD[3][4], 1999, 2001). There are many ways to develop high technology industrial cluster in the spatial planning disciplines. Therefore, the following will be discussed the two key concepts, cluster and spatial developing pattern briefly.

The emergence of industrial cluster concept can be traced to the late 19th century and Alfred Marshall's observations about industrial district in the UK. According to his concept, when the firms start agglomerating in one place, it will produce the competitive advantage in terms of the phenomenon with specialized skills, subsidiary industry and technological spillovers (Krugman[5], 1991). Weber[6] (1929) proposed the agglomeration economics which emphasized the co-location can reduce operation cost by internal and external economics. These theories provide the important theoretical explanation about why firms have to concentrate in one place, and then indicate the ability to control the markets and production inputs will determine whether the concentration would happen. Maurel and Sedillot[7] (1999) also found that some highly firm-density areas in US and Japan have highly positive influence on their productivity. However, there are many scholars proposing different points to see

[3] OECD, *Boosting Innovation: The Cluster Approach*, 1999.

[4] OECD, *Innovative Clusters: Drivers of National Innovation Systems*, 2001.

[5] Krugman, P., *Geography and Trade*, Cambridge, MA: MIT Press, 1991.

[6] Weber A., (1929) *Uber den Standort der Industrien* ,translated by FRIEDRICH C. J. ,1929, *Alfred Weber's Theory of the Location of Industries*, University of Chicago Press, Chicago), translated in Chinese,http://www.hcclib.net/pdf/default.htm.

[7] Maurel F. and Sedillot B., A measure of the geographic concentration in French manufacturing industries, *Regional Science and Urban Economics*, 1999, 29(5): 575-604.

whether cluster is useful for economic development. Saxenian[8] (1994) discussed two experiences between Silicon Valley and Route 128 to describe the point that agglomeration can't explain why two regions under the same condition developed totally different.

Therefore, Hill and Brennan[9] (2000) clearly identified the definition of industrial cluster with competitive advantage is a geographic concentration of competitive firms or establishments in the same industry that either have close buy-sell relationships with other industries in the region, use common technologies, or share a specialized labor pool that provides firms with a competitive advantage over the same industry in other places. The first part is necessary condition (a geographic concentration of competitive firms or establishments in the driver industry or industries); the others are combined with at least one of the other three parts before a group of industries can be considered an industrial cluster. Form the above definition, we can find that the firms concentrating in one place not only could reduce the production cost in common, but also create the competitive advantage by fierce inter-firm competition and knowledge diffusion. Hence, critical to a region's moving to the next stage of development is that the indigenous industry begins to generate cluster economies.

There are many ways to develop high technology industrial cluster, in the spatial planning disciplines, various kinds of planned development arouse: science park, technopolis, technopole, among others. Castells and Hall (1994) described that these projects exist "on the periphery of virtually every dynamic urban area in the world", and they "constitute the mines and foundries of the informational age". The most frequent way in Taiwan is the "Science Park", now, the trend is the "Science City". The Science Park plays the role of a driver to create the science field. In academic or professional arena, there is no globally accepted definition for either science park or technopolis. With respect to the meaning of science park, International Science Park Association (IASP) and Association of University-related Research Park (AURRP) are two major international organizations for the study and promotion of science park development; United Kingdom Science Park Association (UKSPA) is perhaps the most active national organization. Science park definitions set by these organizations have been widely adopted in literature. Some researchers gave science park a broader meaning, that is, to use it as the generic term to cover a range of high technology industry development types (Debenham et al, 1983; OECD, 1987; Kung, 1995); others identify it as one specific type among the related industrial development categories (Couvidat and Giusti 1991; Castells and Hall, 1994; Spolidoro, 1998; ULI, 2001). The latter is basically a direct descendent of the first planned high technology industrial development -- Stanford Research Park, and most notably prevails and appears in Nother America, United Kingdom and Australia. Couvidat and Giusti (1991: 16) regard this narrower defined science park as "a model of organization for technopolises based on Anglo-Saxon tradition of university campuses, established on the outskirts of towns". Castells and Hall (1994) grouped famous examples like Cambridge Science Park, Sophia Antipolis and Hsinchu Science Park in one category and titled it "technology park" certainly gave way to discussion of difference between science park and technology park, we will touch this point in Taiwan's context, nevertheless, the author consider that the above quoted characteristics given by Couvidat and Giusti is common to both terms in general.

"Technopolis" is now translated as "science city" or "science and technology city" in Chinese language, and are interchangeable in common usage. However, science city appears earlier in Chinese literature. According to author's knowledge, the first science city project introduced to Taiwan readers in Chinese is Akademgorodok, and literally translated as "Science City of Siberia" in 1965. This was followed by Tsukuba project. At any rate, the pure R&D-oriented science city gives people the image of a collection of "ivory tower", and seems very remote to the general public. Thus, the more popular concept is the latercomer "technopolis" introduced in mid-1980s, translated as "science and technology city" or "technology-intensive city", where "technology" gives a more application-oriented sense, hence, a

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[8] Saxenian, A., *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Cambridge MA: Harvard University, 1994.

[9] Hill, E. W. and Brennan, J. F., A Methodology for Identifying the Drivers of Industrial Clusters: The Foundation of Regional Competitive Advantage, *Economic Development Quarterly*, 14 (1): 65-96, 2000.

better linkage between R&D and business circles maybe promoted; and by “city”, not only industrial but all other urban activities are possible components.

The successful experience of development of high technology industrial cluster in TSP encouraged the government to establish the industrial cluster. Therefore, in view of the environment of KSP, the industrial background in the surrounding area and global market trends, an establishment project for developing the biomedical devices industrial cluster is executed. The period of the first phase of this project was 4 years, from 2009 to 2013. The goal of this project is to attract over 15 companies to tenanted in STSP, the total investment amount could reach to NT$ 50 billion, which is equivalent to US$ 1.67 billion. With the purpose to induce local innovation capacity, this project was subcontracted to MIRDC to execute. After executing for 4 years, 37 medical device companies are tenanted in STSP and the cluster was formed.

4. The Regional Development of Luzhu District

After the medical device cluster was formed, the circumstance of the city is changed. Thereafter, we will investigate the regional development of Luzhu District from the following factors: the population, transportation, the number of employee, the tenanted companies and the number of supermarket in the surrounding area, which includes Gangshan and Luzhu.

The history of population

Kaohsiung is a modern metropolis located in southern Taiwan as well as the second largest city of Taiwan. The total area is approx. 2946.2671 km^2 and the population is approx. 2,270,000. In this part, we have investigated the migration of the people in Luzhu District and northern Kaohsiung and tried to find the evidence that Luzhu District.

Most of the people in Kaohsiung live in the city, especially in Lingya District, San Min District, Zuoying District, Fongshan District and Nanzih District. Luzhu District is also located in northern Kaohsiung; however, it is just a small town and people here are most farmers and fishermen. After KSP was established, the structure of the economy has been changed. From the population of Luzhu District and the downtown in northern Kaohsiung (Table 1), we could find that the number of population doesn’t increase in Luzhu District. From our study, the reason might be that the people prefer to live in the big city-Gangshan nearby rather than stay in Luzhu because the living function is better. However, it is believe that once the living function of Luzhu District has been improved, the population in Luzhu District will increase.

Figure 2: Kaohsiung City Map

Table1. The population of Luzhu District and the downtown in northern Kaohsiung

Year	Luzhu District	Growth rate	Downtown in Northern Kaohsiung	Growth rate
2007	54,576		1,559,165	
2008	54,369	-0.379%	1,564,399	0.336%
2009	54,137	-0.427%	1,569,462	0.324%
2010	53,791	-0.639%	1,573,714	0.271%
2011	53,443	-0.647%	1,576,051	0.149%
2012	53,145	-0.558%	1,579,454	0.216%

Source: Kaohsiung City Government

The development of public transportation

In the beginning of the establishment of KSP, there is no shuttle bus service in it. First of all, a highway intersection which is connecting the KAP and the downtown was finished construction in 2009. People who would like to go to KSP are always by motorcycle, by car or by taxi. There are only a few companies located in KSP and it is difficult for the government to set a bus stop in KSP. With the increase of the companies tenanted, the STSPA decided to provide the public transportation service for the people who work in KSP. Thus, the shuttle bus service was started in September 2012. In addition, Gangshan South Station of the Kaohsiung Mass Rapid Transit System (KMRT) was in operation in December 2012; in the meanwhile, the Kaohsiung City Government announced that KMRT will be extended to KSP. From the development of public transportation, we could understand the history of regional development in Luzhu District.

The number of employee

Before 2009, there are only 5 medical device industries located in KSP and the employees of these companies are less than one hundred. In 2012, the medical device industries in KSP were increased and the numbers of tenanted companies were 24. The employees of these park enterprises were over 600. According to a regional economic theory, an increase of the employment population would also lead to an increase of population in peripheral areas. Employment population is important to regional development.

The number of supermarket

Generally speaking, the supermarket will build in suburb because the rent is lower and the land is wider than in a city. The increase of the supermarket indicated that this area is growing. The only one supermarket is located in Luzhu District from December 2008 until now. Although the number of the supermarket in Luzhu District doesn't increase, there are more and more supermarkets in Gangshan District nearby it. The first supermarket situated in Gangshan District was established in August 2000, the second one was built in November 2009 after KSP established in Luzhu. Then the third supermarket was founded in November 2012, the forth is in May 2013. In the recent years, no development policy or plan was announced from the government in Gangshan District, we thus assumed that the population was increased due to the KSP established in Luzhu.

The type of tenanted companies in KSP

As mentioned above, there are 5 medical device industries located in KSP before 2009. After 4 years, the number of medical device companies in 2012 was 6 times more than the quantity before 2009. It indicated that KSP attracted the target industries successfully in the past 4 years. More and more companies tenanted in KSP and this phenomenon also supports our viewpoint about the regional development of Luzhu District.

5. The Future Strategy

As of 2009, the "Southern Taiwan Biomedical Device Industrial Cluster Development Project" was promoted by Southern Taiwan Science Park Administration (STSPA) for four years. In the past four years, 37 medical device enterprises tenanted in Southern Taiwan Science Park, and the turnover of these park enterprises had been around US$25 millions.

In the future, STSP needs to improve its competitive advantages continuously to attract more companies to tenant in STSP. Therefore, 5 development directions have been identified in the next four years. First, the park enterprises will be encouraged to develop innovative products by obtaining the subsidy from STSPA. Second, the innovative strategy of international marketing will be adopted. Third, a suitable investment environment should be created. Fourth, STSPA would provide the straight-line service. Fifth, the assistance in medical device regulation should be provided as well.

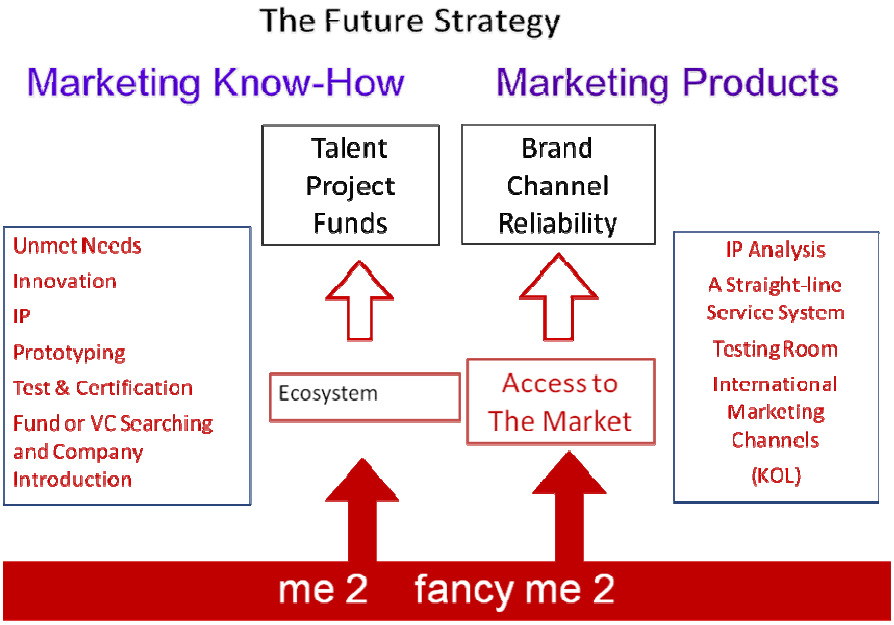

Figure 3: The Future Strategy

In the next step, the focus is marketing know-how and marketing products. Regarding to marketing know-how, we would figure out unmet needs such as direct talking to doctors in the hospitals and then help teams with technologies to create the product, which can be launched to the market. We would pave their ways to enter the market by providing linking to professional R&D centers or financial companies. IP, law, accounting or prototyping, testing services are all provided. As for marketing products, business matching events or tradeshows are our ways and the scope also includes international market. It is believed that by marketing know-how and products, new products can be created and the products can be sold internationally.

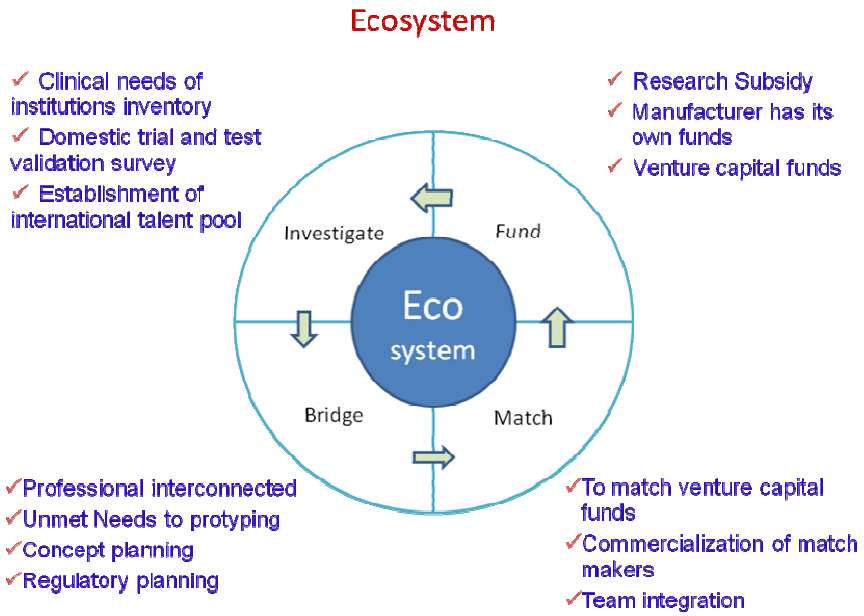

Figure 3: The Concept of Ecosystem

One of the original concepts of our strategy is from the “ecosystem”. The park enterprises could apply for the project to get financial support provided by the STSPA, and the STSPA also help the park enterprises to match with venture capital funds. While the industries get funds, they could do R&D to create innovative products easily without concern for the source of funds.

The investigation of clinic needs, domestic trial and test validation and international talent pool is one of the key points for the ecosystem as well. In this part, the role of the government is like the consultant who obtains much information from different fields, and the industries can get help from government completely.

It always takes a long time for the medical device manufactures to launch their new products into the market. The government would be a bridge among the academia, research institution, medical university and industries to assist them to cooperate with each others. In other words, the government has the resource to connect the academia, research institution, and medical university with industries.

The final part of the ecosystem is “match”. As aforementioned, the government could be a sponsor, a consultant, a bridge and finally a match-maker. To connect and combine with capabilities from different fields is the last mission of the government. It is believed that the industries would develop smoothly and more innovative products will be created after the establishment of ecosystem. When the products become mature, the way to access into the international market will be wide.

In the next phase of this project, innovation capability is the core competitive element for manufacturer and the government would help the industries to develop, finally, the goal will be to establish the ecosystem. In addition, in order to access to the market, marketing will be the most important strategy for the next phase.

6. Conclusion

This study explained the scheme of science park and science city, and it also indicated that the industrial cluster plan needs not only suitable policies, but also the core element - science park. With combination of development of the surrounding area, a science city would be formed. This study takes Kaohsiung Science Park for example; we analyzed the development of Kaohsiung Science Park as well as the surrounding area. The result shows that the science park in Taiwan is developing with a different module to create a brand new science city.

Before the establishment of KSP, southern region of Taiwan were famous for its complete steel and chemical clusters. Kaohsiung has been the major steel and petrochemical industrial centre in Taiwan. With the variety of materials and the convenience of the biggest harbour of Taiwan, metal works and precision machinery SMEs have clustered in Kaohsiung and the southern Taiwan region, and are still a significant industrial sector in the early 21st century (Yen and Kung, 2008). Yet, with the uprising industrial competition from China and ASEAN countries, many of these SMEs have to find new ways of production or higher value-added and more sophisticated products if they choose to stay instead of moving out to other lower cost countries (Yen and Kung, 2012). The STSPA therefore make the policy for developing the MD industry.

Regional development is an important issue for many developing cities, and what strategy adopted by the government to promote the regional development is one of the influent factors. With the collection of information about the history of population, the development of public transportation, the number of employee, supermarket and the type of tenanted companies in Kaohsiung Science Park for four years, we are trying to analyze how the Kaohsiung Science Park changes the industry in the city; in addition, how the government, Southern Taiwan Science Park Administration (STSPA), cooperated with local research institute, Metal Industries Research & Development Centre (MIRDC), to help the traditional industries upgrading and transforming into high value-added medical device industry.

The research found that only 5 medical device industries were located in Kaohsiung Science Park (KSP) before 2009, and 24 medical device industries are in KSP in 2012. The employees of the tenanted industries are almost one hundred in 2009, and the employees increased every year. In 2012 the number of the employee reached to over 600. The quantity of the supermarket in the surrounding area is increased as well. In addition, the public transportation in Luzhu District which is the location of the KSP, is getting more and more convenient. A highway intersection which is connecting the KSP and the

downtown was finished construction in 2009; the shuttle bus service among the train station, The Kaohsiung Mass Rapid Transit System (KMRT) and KSP started in September 2012. The Kaohsiung City Government also announced that the KMRT will extend to KSP in the future. From the above evidence, we acknowledge that the history of regional development in Luzhu District after the establishment of the KSP. From this study, we could also find that the strategy for the next stage by learning the regional development of Luzhu District.

In the next four years, Kaohsiung Science Park will under the construction of ecosystem to help the industry development. The concept of the ecosystem is to create more interactive opportunities between R&D sectors and the industries, then become a “Cycle”. How to help attract the industries to tenant in the science park is a big issue, and the regional development of Luzhu District is an important factor. The regional development and good environment are the key points of attraction of industries and employee. In the past four years, Kaohsiung Science Park constructed the environment through attraction of industries; however, it is the first step for the science park. In the future, how to combine with the ecosystem and regional development in Luzhu District will be the key factor for Kaohsiung Science Park.